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PRESERVATION
Tech Notes
NATIONAL PARK SERVICE
U.S. DEPARTMENT OF THE INTERIOR
WASHINGTON, D.C.

MUSEUM COLLECTION STORAGE

NUMBER 1

FORT PULASKI NATIONAL MONUMENT

Savannah, Georgia

Fort Pulaski, a nineteenth century coastal fortification, was designed by the French military engineer Simon Bernard and built to protect the river approaches to the city of Savannah, Georgia. Begun in 1829, the massive casemated brick structure surrounded by a moat was completed in 1847. Fort Pulaski contains more than 60 casemates, or brick vaulted spaces, intended to be bombproof; many were built to protect the large complement of guns and powder. The remaining casemates were built as bombproof rooms and barracks for officers and troops.

Military history was made at Fort Pulaski in 1862 when the Confederate garrison occupying the fort was forced to surrender because of extensive damage caused by a Federal bombardment using heavy rifled artillery. This was the first time that rifled artillery had forced the surrender of a large masonry coastal fortification.

The fort became part of the National Park System in 1933 as a national monument, and is open to the public as a museum.

Problem

The park has a collection of several thousand historical and archeological objects significant to the history of the occupation and use of the fort; but these objects were in need of a proper storage facility. The park is responsible for protecting these objects against damage, the most pervasive of which is the environmental damage caused by the seacoast setting. The climatic conditions at Fort Pulaski reflect typical southern coastal conditions of high-relative humidity, widely fluctuating annual temperatures, and salt-laden air. These are the same conditions that cause or contribute to chemical, physical, and biological deterioration of museum objects.

Museum Object Storage Requirements

For Fort Pulaski, the museum object storage requirements were determined to be as follows:

1) The storage facility must provide proper environmental control for the objects;
2) The storage should provide security and fire protection;
3) The object storage should be readily accessible to the staff;
4) Any new storage facility should be visually compatible with the historic fort;
5) The cost of providing storage for museum collections should be reasonable;
6) The park should have the ability to relocate the facility if needed in the future;
7) The storage facility should be developed with the least amount of alteration or damage to historic and archeological resources in the park.

Museum Collection Storage in an Historic Building Using a Prefabricated Structure

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With proper measures, storing museum objects in an historic structure should assure the long term preservation needs of the objects without adversely impacting the integrity or the character of the historic structure.

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The park management staff considered the following approaches to provide a permanent collection storage facility: 1) constructing an addition to the visitor center; 2) constructing a facility at the maintenance complex; and 3) retrofitting one of the historic casemate rooms within the fort.

Constructing an addition to the Visitor Center (which is modern and circular in form) was rejected due to the visual impact and the prohibitive cost. A new facility at the maintenance complex likewise was unacceptable because the objects would be less accessible to staff and the cost of construction was the highest of the three alternatives.

Even though the third approach, retrofitting an historic casemate to create an adequate museum object storage facility, would meet most of the requirements, there were some major obstacles. The foremost obstacle was the problem of controlling the environment within the historic brick vaulted casemate. Adverse climatic conditions were not the only problem which had to be dealt with; the fort had been built on low ground only eight feet above sea level. Furthermore, moisture from the surrounding moat had penetrated the lower portions of the fort. Efforts over the years to prevent this seepage had been unsuccessful, resulting in permanent dampness in the substories beneath the floors of several casemates. The only barrier separating the storage area from the damp substory was a floor of heavy wooden boards.

Environmental Concerns

The ranges of humidity and temperature present in the historic casemate far exceeded those necessary to promote preservation of the museum objects. A good collection storage environment is one that controls and reduces the range and fluctuations of temperature and humidity, prevents damage from dust, pollutants and light, and eliminates insect and rodent infestations.

Control of temperature and relative humidity is of primary importance. Fluctuations and extremes in temperature and relative humidity (RH) cause physical stress and chemical deterioration of museum objects. The goal in preventing damage is to keep the temperature and relative humidity as constant as possible throughout the year. For many museum objects in the southeastern U.S., deterioration is minimized by keeping the annual range of temperature between 16-24° C (60-75° F) and the relative humidity between 45-55%. The rate of change within these ranges ideally should not exceed 3% relative humidity and 2° C per month.

Besides controlling temperature and relative humidity, the room air should be filtered for dust by a high-efficiency particulate-air filter, and gaseous pollutants should be filtered by activated charcoal air filters.

Figure 1. Fort Pulaski site plan, showing the arrangement of open gun galleries around the north, east, and south sides. The western or "rear" section of the fort contains the entrance or sally port and a range of vaulted rooms, or casemates, which flank the sally port. The second casemate south of the entrance (denoted by the arrow) is the one selected for the park museum object storage facility.

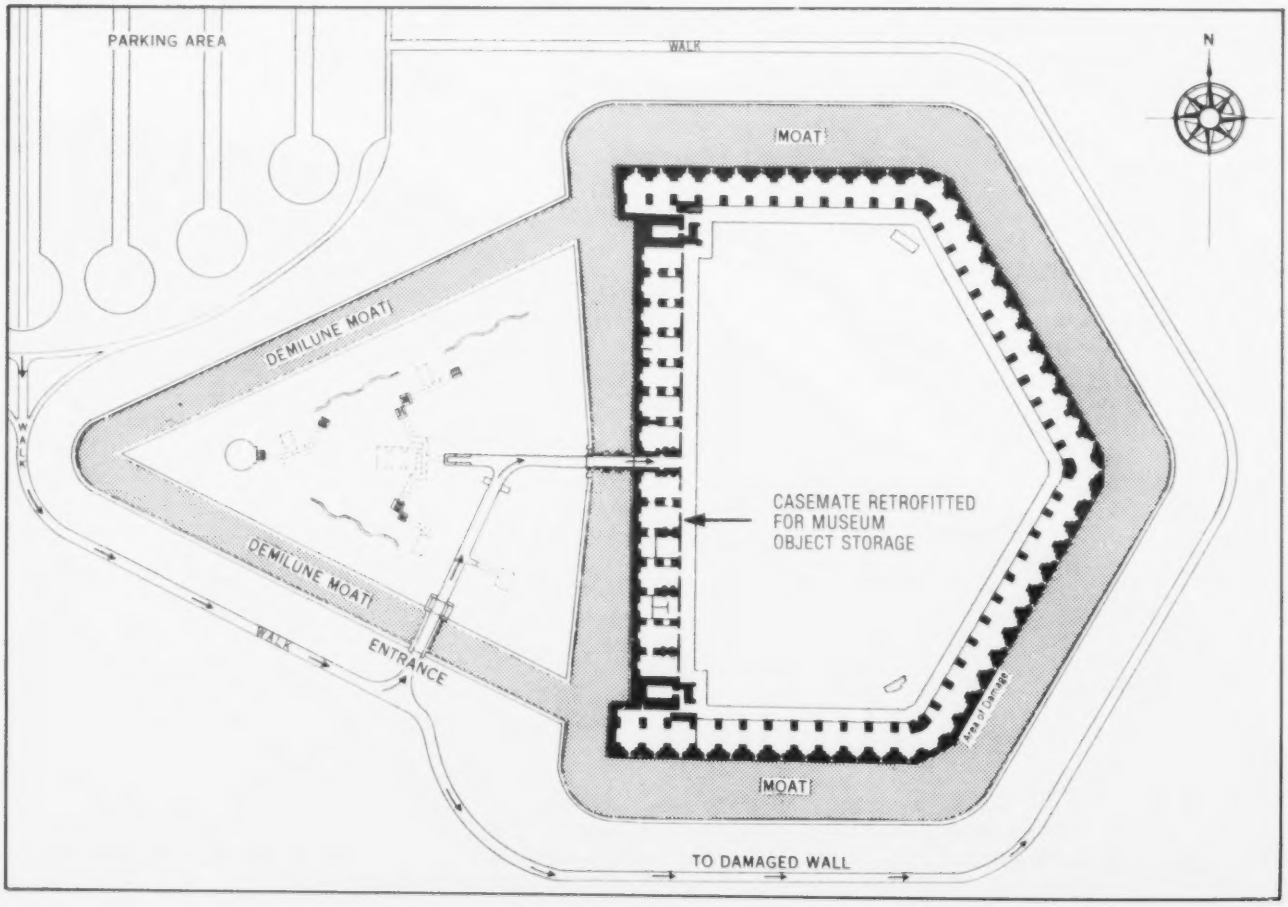


Figure 2. View from one of the open casemates, looking across a portion of the parade ground. The piazza provides a covered access to the enclosed casemates which flank the sally port. It was one of these enclosed casemates (each has a door and one or two windows) that was selected to house the museum object storage facility.
Photo: Robert Darrigan

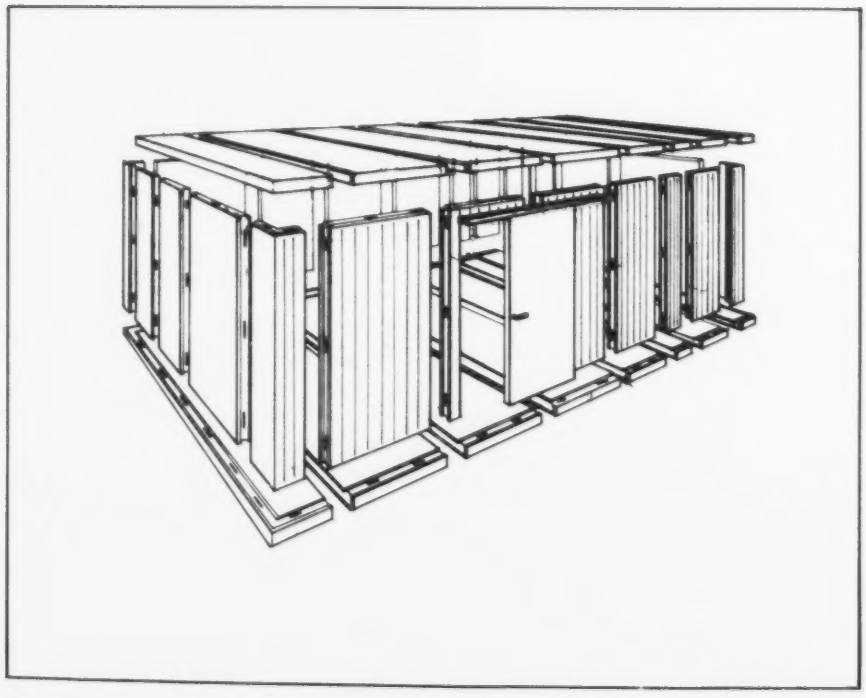


Figure 3. Exploded view showing the various units that comprise the walls, corners, floor, ceiling and sliding doors—all of which were assembled by park staff within one of the historic casemates at Fort Pulaski. This prefabricated system is suitable for storing and preserving museum collections because of its thermal efficiency and because its joints are nearly airtight.
Drawing: Christina Henry

Solution

The park staff decided to install within a casemate a free-standing structure that could maintain the appropriate environmental conditions necessary to preserve the collection (see figures 1 and 2). They considered both retrofitting a casemate using conventional construction methods and assembling a prefabricated structure within a casemate. A prefabricated thermally efficient structure was selected because of easy assembly, lower cost, minimal physical and visual impact on the structure, high insulation characteristics, and ease of future removal. With the assistance of the author and the staff curator of the National Park Service, Southeast Regional Office, the park staff assembled a museum storage facililty within an historic casemate utilizing a commercially available prefab building system (see figure 3).

This type of storage containment, similar to a walk-in refrigerator, is considered to be state-of-the-art in collection storage by many in the museum community. Such an approach has been used by several other parks and by the Smithsonian Institution. Whereas a conventional wood framed and insulated "container" may be made capable of maintaining conditions appropriate to museum object preservation, this particular prefab system can achieve the same results at much lower operating and capital costs.

Assembly

The prefabricated modular panels are made of a four-inch thick polyurethane foam core (insulation value of R-34, "U" factor .029), sandwiched between two sheets of galvanized steel. These commercially available panelled structures are designed to maintain strict temperature and relative humidity levels, and are more frequently used for such purposes as cold storage rooms or for housing electronic equipment.

The space in the historic casemate where the prefab unit was to be erected measured about 18′ by 32′ with an arched vaulted ceiling. Within this space, it was possible for the park staff to erect a prefab storage room measuring 13′6″ wide by 20′2-1/2″ long by 10′6″ high, including insulated walls, floor, and ceiling. Since the panels required only a wrench to lock them together, the

273 square foot storage room required only 50 man hours for assembly (see figure 3). There is just enough room between the prefab unit and the walls and ceiling of the historic casemate for maintenance access and to assure ventilation within the casemate. This prefab unit has a total weight of 6,350 pounds (not including the contents), and was placed directly on the heavy wooden floor of the historic casemate.

The park staff wired this new storage facility with 110 volt electrical outlets, and installed incandescent lights, and a heat pump for heating and cooling. Dehumidifiers (or humidifiers) may be added later if observed readings from a year-long operation of the hygrothermographs indicate that there is a need. The climate control system for the storage room will maintain conditions appropriate for the museum collection—independent of the other rooms within the fort. To house the museum collection properly, specialized museum cabinets and shelving are arranged as indicated on the floor plan (see figure 4).

Finally, for protection against fire and theft, the existing security and a wired ionization fire detection system in the fort are to be extended to include the new museum storage room. A backup emergency power generating system was not deemed necessary in the event of a power failure because the insulated storage room will maintain acceptable temperature and humidity levels for a day or more.

Project Evaluation

This structure provides sufficient space to house the park's museum collections and the necessary storage equipment for containing them (see figure 5). Additional benefits of this system are its flexibility for future enlargement (up to the limits of the historic casemate) if the museum collections need additional space and the ease with which it can be disassembled and moved at a later time. Also the system is freestanding and thus is not affixed to the fabric of the historic structure.

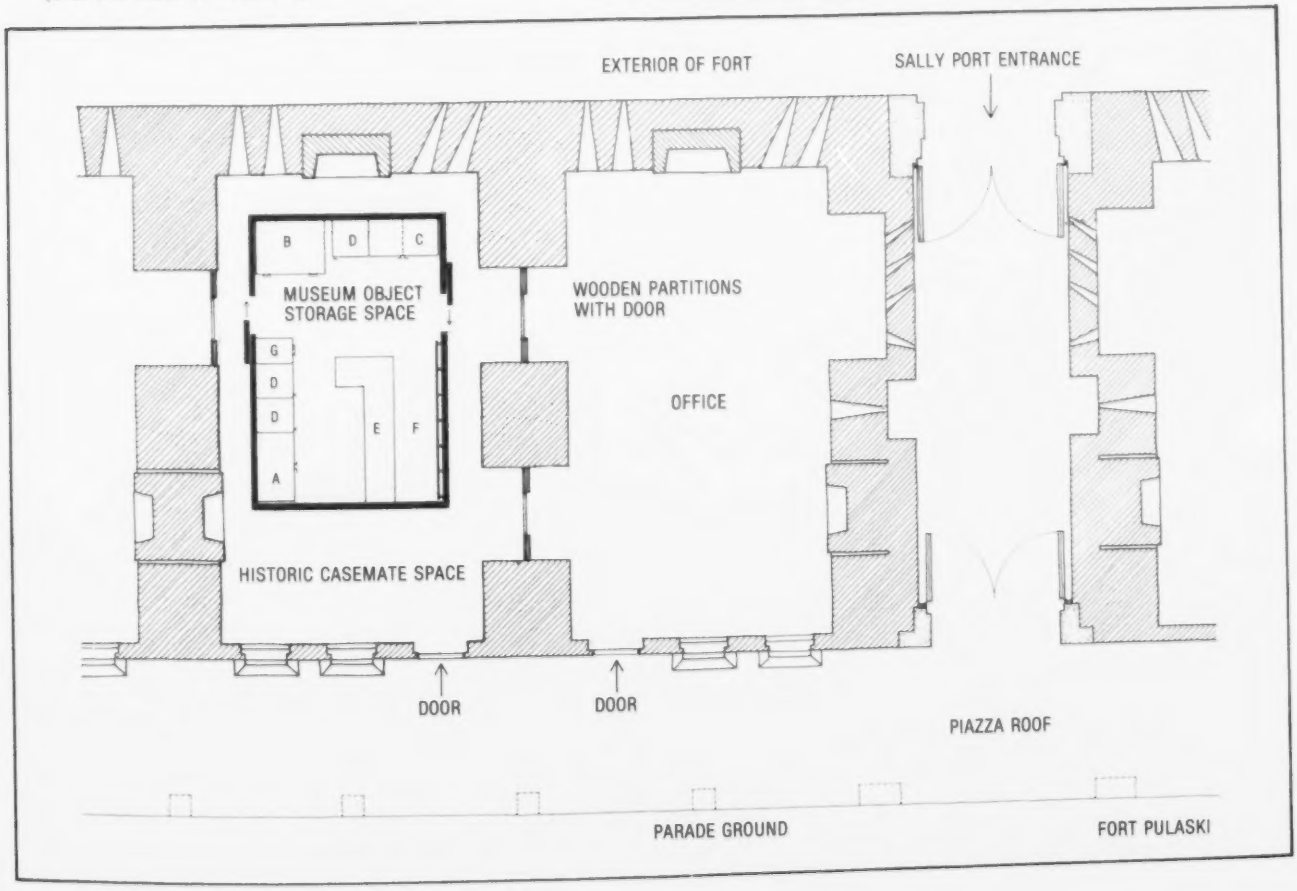
The real value of this environmentally controlled room for object storage is its ability to provide the appropriate temperature and relative humidity conditions to preserve the park's museum collection while it prevents these conditions from affecting and damaging the historic casemate containing the room.

The adaptive use of rooms in historic structures for collection storage occurs frequently in historical parks. The solution of using a panelized "box" to contain museum collections in an historic structure has proved efficient; however, several factors must be taken into account when considering such a storage facility:

1. To house such a museum object storage facility, the physical condition of the historic fabric must be evalu-

Figure 4. Plan of historic casemate with the prefabricated structure assembled inside the casemate to serve as the park museum object storage facility. Drawing: Christina Henry

A - Wardrobe-size museum specimen cabinet
B - Map and blueprint cabinet
C - Double-wide museum specimen cabinet (over two standard cabinets)
D - Standard museum specimen cabinet
E - Dexion adjustable open steel shelving
F - Art storage rack
G - Insulated file cabinet



ated, together with an identification of character-defining aspects of the cultural resource, so that the impact of the new facility can be determined.

2. Although the building system is comprised primarily of polyurethane foam, there is a weight factor to consider. The floor of the historic structure must be able to support the load of the prefabricated "box," as well as the combined weight of museum objects and storage equipment and cabinets, which can be considerable. It is advisable to have an engineer calculate the ability of the historic structure to carry these additional loads.

3. The prefabricated structure must not adversely affect air flow within the historic space, nor should it adversely affect the maintenance needs of the historic space, otherwise additional equipment might be required to assure good air movement (ventilation) and to prevent possible damage to the historic structure as a result of dry rot and moisture problems.

In this instance, the new museum object storage facility provides an appropriate controllable environment for the museum collection. Cost effective and readily accessible to the staff and researchers, the storage facility has had a negligible impact on the historic casemated brick fort.

Figure 5. View inside the object storage room, showing the open steel shelving for bottles and similar objects. Beyond are the map and drawing cabinets and the insulated file cabinet for storage of museum documents. Photo: Raymond Powers

PROJECT DATA:

Building:
Fort Pulaski
Fort Pulaski National Monument,
Savannah, Georgia

Owner:
National Park Service
Fort Pulaski National Monument
Savannah, Georgia

Project Date: March 7-9, 1983

Building Cost:
The prefabricated building, measuring 13 '6" wide by 20 '2 1/2" long by 10 '6" high (273 square feet), delivered knocked down, and consisting of insulated walls, ceiling, floor, and 2 sliding 36" doors, cost $8,263. The assembly required 50 hours of labor by NPS staff at an estimated cost of $500. Cost of installing electrical outlets, light fixtures and heat pump was $5,208. Total cost was $13,971.

Building Supplier:
Bally Engineered Structures, Inc.
Bally, Pennsylvania

Equipment Cost:
The total cost for 10 storage cabinets for museum object storage, an art storage rack, file cabinet and open shelving was $7,494. The object storage equipment consisted of the following:

1 wardrobe-size museum specimen cabinet—73 3/4" high, 58" wide, 32" deep steel locking cabinet with door seal, hat shelf and closet rod for garment storage.

1 map and blueprint cabinet—35 1/2" high, 53 3/4" wide, 41 7/16" deep steel cabinet with large flat drawers for maps, prints and drawings.

1 double wide museum specimen cabinet—36 7/8" high, 58" wide, 32" deep steel locking double-door cabinet for flat storage of light objects such as garments and textiles.

7 standard museum specimen cabinets—36 7/8" high, 29" wide, 32" deep steel locking cabinet with door seal, 16 metal drawers, and lift out or swing door used for heavy duty general purpose object storage.

Dexion adjustable open steel shelving—8' high, using plywood for actual shelving.

1 art storage rack—2" x 2" wood furring strips attached to wall 16" centers, with metal mesh fencing, stapled to furring strips (constructed by park personnel), for hanging framed paintings, etc.

1 insulated file cabinet—52 11/16" high, 20 3/4" wide, 31 1/2" deep, 4-drawer insulated and locking legal size file cabinet with Class C fire rating used for storage of museum documents.

Equipment Supplier:
The Steel Fixture Manufacturing Company Topeka, Kansas

This PRESERVATION TECH NOTE was prepared by the National Park Service. Charles E. Fisher, Preservation Assistance Division, National Park Service, serves as Technical Coordinator for the PRESERVATION TECH NOTES. Special thanks go to Superintendent Daniel W. Brown and the staff of Fort Pulaski National Monument for providing information and photographs concerning the work at Fort Pulaski. Thanks also go to the following Preservation Assistance Division staff who contributed to the production: Lee H. Nelson, FAIA, Emogene Bevitt, Christina Henry, Carolyn Moler, Theresa Robinson, H. Ward Jandl, and Michael Auer. Cover photo: Courtesy, Fort Pulaski National Monument.

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